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Photoemission Study of $\text{Yb}_2\text{Co}_3\text{X}_9$ (X=Ga and Al)

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The isostructural series of compounds $\text{Yb}_2\text{T}_3\text{X}_9$ (T=Co, Rh, Ir; X=Ga, Al) show typical properties of heavy-fermion antiferromagnet for X=Al, while they show mixed-valent behavior for X=Ga. Therefore the $\text{Yb}_2\text{T}_3\text{X}_9$ compounds is a good example to examine the difference in the electronic structure between the heavy-fermion antiferromagnets and the non-magnetic mixed-valent systems. We have studied the electronic structures of $\text{Yb}_2\text{Co}_3\text{X}_9$ (X=Ga and Al) compounds by high-resolution photoemission spectroscopy. In the measurements at 14K, we observed a sharp Yb4*f*-related peak just below E_F for X=Ga while no 4*f*-related signal was observed just below E_F for X=Al. The position of the peak observed for X=Ga is comparable to $k_B T_K$ (T_K : Kondo temperature). The intensity of the peak shows strong temperature dependence. The result is consistent with the behavior of the Kondo resonance peak predicted by the single impurity Anderson model. The origin of the difference between the mixed-valent Ga-based compounds and the heavy fermion Al-based compounds is attributed to the difference in the 4*f* energy position and associated stability of the Yb^{3+} configuration.